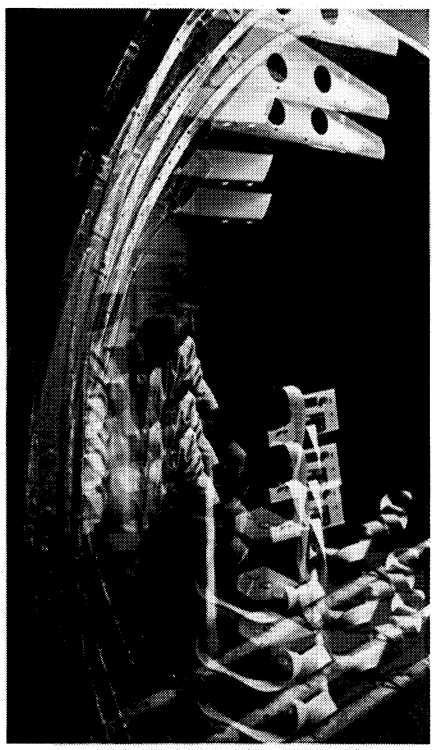
Technology for Smoother Transit

A system for assessing passenger ride comfort exemplifies NASA demonstrations of technology for better ways to meet public needs



At left, project engineer Jack Leatherwood is conducting a test in a Langley Research Center facility that simulates vehicular motion; sensors report information on noise and vibration levels. Test results are computed and printed by the central processor shown in closeup at far right. The sensors and the processor comprise the Langley-developed ride quality meter, an aid to designers of transportation systems for improving passenger comfort in air, sea, road and track vehicles.

In designing transportation systems, one of the toughest jobs is that of the ride development engineer, who must insure that passengers get a smooth, comfortable ride. His problem—until recently—was lack of a completely reliable method for assessing the ride quality of the vehicle being developed. As a result, he was often faced with the necessity of making costly and time-consuming design changes to get an acceptable level of ride comfort.

Langley Research Center has come up with an answer to the problem: a generalized model—applicable to air, sea, road or track vehicles—for estimating passenger ride comfort in the presence of complex vibrations and interior noise. As part of this research, Langley developed a portable, self-contained ride quality meter for assessing ride quality during actual vehicle operations.

More than 3,000 people participated in the model development project. The subjects took turns in Langley's ride quality simulator, where they were exposed to controlled combinations of vehicle vibration and noise. Each then completed a questionnaire detailing the level of discomfort experienced. This input provided the basis for development of the computer model, which transforms individual vibration/noise elements into subjective units, then translates the subjective units into a single discomfort index that typifies passenger sensation of the total vibration/noise environment.

The ride quality meter has three components: a package of vibration sensors, a microphone and a computer. Installed on the floor of the vehicle being tested, the sensors

measure vibration in five different axes: vertical, longitudinal, lateral, roll and pitch. The microphone measures noise levels.

The computer processes the input from microphone and sensors, according to the Langley-developed model, to give the user a printed readout including a number of options for assessing ride quality. Among the options are the total discomfort index; the vibration component of the total; the noise component; discomfort due to individual axes of vibration; discomfort due to individual noise bands; and discomfort corrected for trip duration.

The meter, in essence, serves as a reliable and accurate passenger "jury." It provides the first known capability for summing the effects of noise and vibration into a single ride quality index and, therefore, has attracted a lot of attention. Several automobile and truck companies are interested. Ford Motor Company and Langley teamed to test the meter's ability to assess ride quality in an automobile environment and Ford was sufficiently impressed to initiate purchase of meters. Amtrak has tested the system on its trains. Budd Company and the Department of Transportation have participated in simulator tests and representatives of the helicopter industry, the U.S. Coast Guard, Consumers Union and the Federal Railroad Administration have also expressed interest in the meter's capabilities. NASA has been granted a patent for the invention and Wylie Laboratories, Hampton, Virginia has applied for a license to produce the meter for the commercial market.

The ride quality model and meter exemplify a special area of NASA effort: demonstrations to show how application of advanced technology may help solve major problems or create better ways of meeting public needs. As seems likely in this instance, spinoff products sometimes emerge from such projects. Commercialization, however, is not the primary aim; NASA's intent is to expand public awareness of advantageous technology and inspire its broader application by government agencies, communities, medical institutions and other organizations. The following pages contain additional examples of NASA technology demonstrations.